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ECOLOGIC NOTES ON DROSERA ANNUA

By E. L. Reed

In the spring of 1914 while on a field trip, near College Station, Texas, the writer observed some specimens of *Drosera* growing in an open oak wood that is invading an abandoned field. The habitat was a gentle slope of what appeared to be a comparatively dry, sandy soil. The *Drosera* in question, upon further examination, proved to be a new species to which the name *D. annua* was given.* Later a number of other stations of the same general character were observed and *D. annua* was found to be quite common in the vicinity of the college. In this region the plant was never found in or near ponds or streams; in the eastern part of the state, however, it sometimes grows in moist sand near ponds but has not been reported as growing in or at the edge of bodies of water. Since such a habitat for species of *Drosera* was unusual, an ecologic study was begun, in order to determine the environmental conditions under which it grows.

The climate of this region is warm temperate, or perhaps, subtropical, and is divided generally into a wet and a dry season. The former begins about the middle of November and extends well into March. It in turn may be divided into three periods, two of heavy rainfall separated by one of light rainfall. The first period of heavy rainfall extends to about the beginning of January; in January the precipitation is light, while the second wet period is from about the first of February to the end of March. The summer season is usually one of slight rainfall. The early

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spring flowers, such as the Spring Beauty and the little Bluets, begin to bloom in January.

Table I shows the maximum, minimum, and mean annual temperatures for a period of four years as reported by the Experiment Station.

TABLE I. TEMPERATURES AT COLLEGE STATION, TEXAS

Year	Maximum	Minimum	Mean Annual
1911	106	12	70.7
1912	105	10	67.6
1913	106	18	67.7
1914	106	17	67.4

The character of the vegetation of this region is transitional between the mesophytic of the Mississippi valley and the xerophytic of the Great Plains, inclining to the latter type.

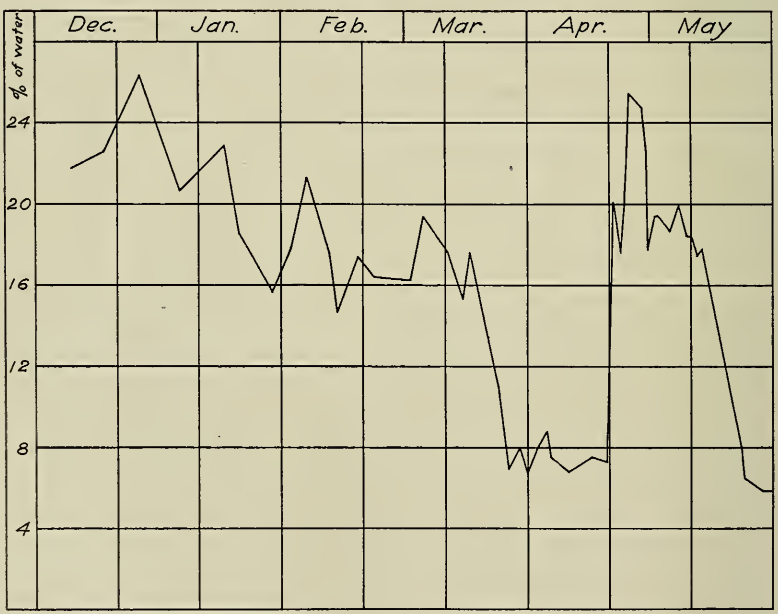

FIG. 1. Graph of water content for period of observation.

In order to determine the water content of the soil of the stations, samples were collected from December 6, 1914, to June 9, 1915. From December 6, to the time of the appearance of the seedlings—about Feburary 1—samples were taken at intervals of four to twelve days, thereafter at intervals of two to six days. Since *D. annua* is small and has a poorly developed root system, most of the soil samples were taken to a depth of from four to six inches only.

Table II shows the date, depth in inches, and per cent of water, in terms of dry soil, of a series of such samples.

TABLE II. WATER CONTENT OF SOIL SAMPLES FROM THE HABITAT OF *Drosera annua*

Date	Depth in Inches	Per Cent Water	Date	Depth in Inches	Per Cent Water
Dec. 6	1 to 6	21.86	Apr. 3	1 to 2	8.50
" 14	1 " 6	22.86	" 3	1 " 5	8.86
" 23	1 " 6	26.47	" 4	1 " 2	7.83
Jan. 3	1 " 6	20.60	" 4	1 " 5	7.34
" 14	1 " 6	22.78	" 6	1 " 5	7.06
" 18	1 " 6	18.48	" 6	1 " 2	7.28
" 18	6 " 12	19.68	" 8	1 " 5	6.82
" 18	12 " 18	21.00	" 14	1 " 5	7.37
" 26	1 " 6	15.63	" 18	1 " 5	7.26
" 26	6 " 12	17.66	" 20	1 " 5	20.13
" 30	1 " 6	17.66	" 22	1 " 5	17.57
" 30	6 " 12	22.00	" 22	1 " 5	16.75
Feb. 4	1 " 6	21.43	" 22	1 " 5	18.26
" 4	6 " 12	21.41	" 24	1 " 5	25.63
" 4	12 " 18	21.23	" 27	1 " 5	24.71
" 10	1 " 6	17.69	" 28	1 " 5	22.59
" 12	1 " 6	14.63	" 29	1 " 5	18.48
" 12	6 " 12	22.46	May 1	1 " 5	19.23
" 17	1 " 5	17.53	" 2	1 " 5	19.17
" 21	1 " 5	16.45	" 5	1 " 5	18.87
Mar. 2	1 " 5	16.25	" 7	1 " 5	20.06
" 3	1 " 5	20.36	" 8	1 " 5	18.55
" 6	1 " 5	19.66	" 9	1 " 5	19.40
" 9	1 " 5	17.52	" 11	1 " 5	17.38
" 13	1 " 5	15.13	" 12	1 " 5	17.77
" 14	1 " 5	17.42	" 13	1 " 5	18.82
" 22	1 " 5	19.87	" 15	1 " 5	14.75
" 24	1 " 5	6.80	" 19	1 " 5	10.55
" 25	1 " 5	7.15	" 22	1 " 5	7.80
" 26	1 " 5	8.12	" 23	1 " 5	6.40
" 28	1 " 5	6.52	" 23	1 " 5	6.70
" 30	1 " 5	7.38	" 27	1 " 5	5.72
" 30	1 " 2	6.47	" 29	1 " 4	5.12
" 30	1 " 2	3.46	" 30	1 " 5	5.77

Fig. 1 shows a graph of the water content for the period of observation. Fig. 2 gives the rainfall in inches for the same period, as reported by the Experiment Station. The rainfall for three years divided into two periods each is shown in Table

III. By reference to Figs. 1 and 2, it will be seen that the water content of the soil bears a more than usually close relation to the rainfall. This may in part be accounted for by the fact that the subsoil is only from twelve to eighteen inches below the surface and is a hardpan almost impervious to water. The drainage is therefore poor. Moreover the structure of the soil is such that a very few days of dry weather causes a rapid decrease in its water content.

Table III. Rainfall at College Station, Texas

Year	Nov. 1 to May 31, Inches	June 1 to Oct 31, Inches	Total, Inches
1912–1913	22.50	7.92	30.42
1913–1914	38.20	10.93	49.13
1914–1915	30.20	17.07	47.27

From Table IV it appears that during the time of observation there were two periods of high water content and two of low in these soils.

Table IV. Water Content of Soil Samples by Periods

Period	Maximum Per Cent	Date	Minimum Per Cent	Date	Mean
Dec. 6 to Mar. 22	26.47	Dec. 23	10.26	Mar. 22	18.53
Mar. 22 to Apr. 18	8.86	Apr. 3	6.52	Mar. 28	7.33
Apr. 18 to May 19	25.63	Apr. 24	10.55	May 19	18.45
May 19 to May 30	7.80	May 22	3.82	May 29	6.28

The young Droseras appeared about the middle of the first period of high-water content and disappeared shortly after the beginning of the last period of low-water content. However, on March 30, the plants in the upper portion of the field were found to be dying. Upon examination the first two inches of soil of this part showed a water content of 3.46 per cent, as compared with 6.47 per cent in samples of like depth from localities in which the plants were still growing. The plants grew vigorously in all places having a water content of 6 per cent or more during the period from March 24 to April 18. The rosettes of leaves reached a maximum size in most of the plants and the scapes attained a height of one centimeter or more. The first blossoms appeared about April 30.

A careful study of the soil of several habitats confirmed the observation that *D. annua* grows normally with a water content of six per cent; when the proportion falls below this minimum the plants die. The soil on analysis was found to contain 0.02 per cent nitrogen.* A mechanical analysis gave the following:†

	Per Cent
Very fine sand	84.78
Silt	8.12
Clay	7.10

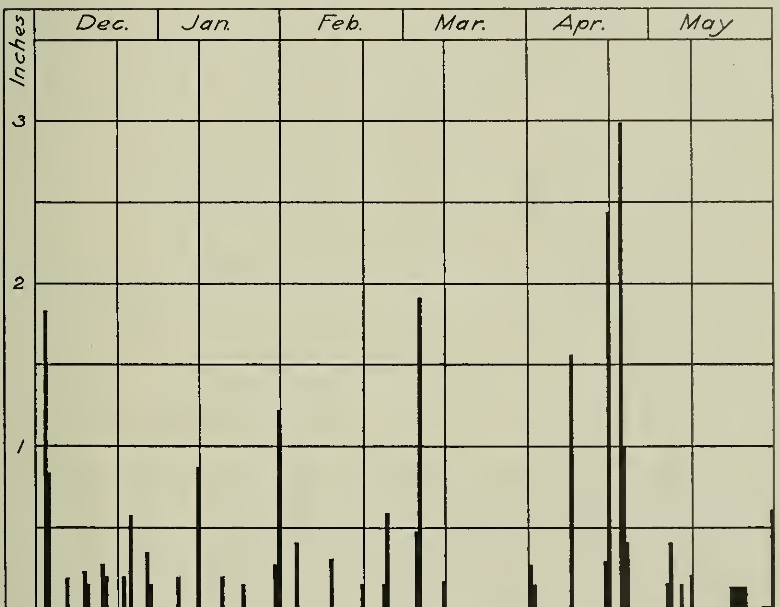

FIG. 2. Graph of rainfall for period of observation.

The soil is therefore a fine sand, poor in nitrogen. Owing to the impermeability of the subsoil, the overlying soil becomes water-logged during heavy rains, or a series of showers, but its porous sandy nature permits rapid drying. Figs. 1 and 2 show this graphically.

* Analysis made by Mr. M. T. Garret, senior student in agronomy, A. and M. College.

† Analysis made by Professor C. A. Wood, of the Department of Agronomy, A. and M. College.

A study of a meter quadrat in a typical field during the month of May, 1915, gave the following result:

Phlox tenuis	189
Oenothera lineafolia	44
Oenothera sinuata minima	13
Krygia occidentalis	43
Rumex hastatulus	41
Linum multicaule	13
Sabbatia campestris	30
Lechia Drummondii	31
Drosera annua	52
Hedeoma (not identified)	270

Outside of the quadrat but associated with *D. annua* were the following:

Linaria canadensis
Lepidium intermedium
Castilleia indivisa
Asclepiodora viridis
Geranium carolinianum
Legousia perfoliata
Allium Nuttallii
Verbena Halei
Linum medium
Oenothera serrulata
Talinum parviflorum
Lepuropetalon spathulatum
Polygala incarnata
Tithymalus leiococcus
Jatropa stimulosa
Opuntia grandiflora
Helianthemum rosmarinifolium
Tragia ramosa
Diodea teres
Houstonia patens
Crusea allococca
Polypremum procumbens

No attempt was made to identify the grasses and plants below the spermatophytes growing in the quadrat.

Summary.—Drosera annua is an annual, appearing about February 1.

The soil is a fine sand with a small per cent of silt and clay. Hence it dries rapidly. The nitrogen content is low.

The water content of its habitat ranges from six to twenty-five per cent during the life period of the plant.

The minimum requisite of water in this particular soil, as shown by the death of the plants, is six per cent, while the optimum lies somewhere beyond this point.

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